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Process of leaching a lateritic ore for preparing metal extraction

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Abstract

The starting material is lateritic ore which contains nickel oxide and/or cobalt oxide. From water and comminuted ore, of which at least 80 wt-% have grain sizes of not more than 0.5 mm, a pumpable suspension is formed. The ore-containing suspension is passed through an indirectly heated preheating tube, the suspension being heated to 150 to 250°C. The heated suspension is passed through a mixing line in which an acid in a minimum amount of 10 kg per 100 kg ore, calculated anhydrous, is admixed to the suspension, and the acid-containing suspension is passed through a dwell time tube in which the dwell time of the suspension is at least 0.1 minutes. Preferably, sulfuric acid is introduced into the mixing line.

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COMPLETE SPECIFICATION

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Application Number:

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Invention Title: **Process of Leaching a Lateritic Ore for Preparing Metal Extraction**

The following statement is a full description of this invention, including the best method of performing it known to :- us

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Process of Leaching a Lateritic Ore for Preparing Metal Extraction

This invention relates to a process of leaching a lateritic ore, which contains nickel oxide and/or cobalt oxide, for preparing the extraction of at least one metal.

It is known that a tubular reactor plant substantially comprises three sections, namely the indirectly heated preheating zone, the reaction zone in the form of a dwell time tube, and finally the cooling and expansion system. During expansion, temperature and pressure are decreased by partial evaporation of the suspension. The steam obtained thereby can be used in the preheating zone.

When leaching oxide, it is known to add the chemicals which effect the digestion to the ore-water suspension before the preheater. The consequence is that the digestion reaction can already start before the dwell time tube at a reduced reaction rate, so that the entire reaction time is prolonged. It is disadvantageous that already during preheating with rising temperature various digestion products can be formed, which are undesired. Moreover, products of the digestion already starting in the preheater can form crusts therein, which can

greatly impede the transfer of heat. This encrustation can lead to increased maintenance costs and an only restricted availability of the plant.

It is the object underlying the invention to perform the above-mentioned process as inexpensively as possible and to ensure that there is no encrustation in the preheating zone. In accordance with the invention, this is achieved in that from water and comminuted ore, of which at least 80 wt-% have grain sizes of not more than 0.5 mm, a pumpable suspension is formed, that the ore-containing suspension is passed through an indirectly heated preheating tube, the suspension being heated to 150 to 250°C, that the heated suspension is passed through a mixing line in which an acid in a minimum amount of 10 kg and preferably at least 50 kg per 100 kg ore, calculated anhydrous, is admixed to the suspension, and that the acid-containing suspension is passed through a dwell time tube in which the dwell time of the suspension is at least 0.1 minutes and preferably at least 1 minute. Now, encrustation or disturbing corrosion need no longer be expected in the preheating tube.

Advantageously, the ore-containing suspension is pumped into the preheating tube, and in the preheating tube a static pressure of 30 to 200 bar and preferably at least 120 bar is maintained. Expediently, the increased pressure is also maintained in the mixing line and in the dwell time tube. The increased pressure leads to an increase of the boiling temperature and provides for higher operating temperatures. Leaching is thereby intensified quite considerably, but without overproportionally increasing the investment costs. Surprisingly, sulfuric acid will be admixed to the suspension in the mixing line, but there may also be used some other mineral acid to improve leaching. It may be recommended to introduce the sulfuric acid or some other acid into the mixing line after hav-

ing been preheated to temperatures e.g. in the range from 40 to 200°C and preferably at least 80°C.

The dwell time tube mostly is of considerable length, in order to achieve the desired dwell time of the suspension. The length of the dwell time tube usually is above 100 m and may also be more than 1000 m. To achieve the desired effect, the acid-containing suspension will be withdrawn from the dwell time tube with temperatures in the range from 250 to 350°C.

By means of the inventive process it is achieved that moving parts, which get in contact with the acid-containing suspension, can be omitted.

Embodiments of the process will be explained with reference to the drawing, in which:

Fig. 1 shows a flow diagram of the process,

Fig. 2 shows the region of the mixing line in a longitudinal section, and

Fig. 3 shows an enlarged cross-section along line III-III of Fig. 2.

A container (1) contains an ore-water suspension, which by means of the high-pressure pumpe (2) is first of all passed through the preheating tube (3), then through the mixing line (4) and through the dwell time tube (5). Subsequent to the dwell time tube (5) an expansion container (6) is provided, which may also have a multi-stage design. Subsequently, the suspension flows through line (7) to the extraction (8) known per se for metal recovery. The preheating tube is surrounded by a heating jacket (9), through which flows a heating fluid (e.g. steam or heat transfer oil). The preheating tube may

also be divided in several portions which are heated differently.

The mixing line (4) is represented in a longitudinal section in Fig. 2 and in a cross-section in Fig. 3. The outer metal tube (4a) surrounds an inner lining in the form of acid-resistant molded bricks (10) which are joined in an interlocked way. The molded bricks are conically tapered in certain portions in the direction of the flow direction (11) of the suspension. This results in a deliberate irregularity of the inside of the flow region of the mixing line. The acid which is added to the suspension through the feed line (12) is mixed due to the strong turbulence formed in the flow region after a short flow path. In contrast to the representation of Fig. 2, the desired turbulence for quickly mixing suspension and acid in the vicinity of the mixing line (4) can also be achieved by other stationary flow obstacles in the flow region of the suspension.

From the preheating tube (3), the suspension usually comes with a temperature in the range from 150 to 250°C and in the mixing line (4) absorbs the acid in the necessary amount. The amount of acid addition depends on the composition of the ore, in particular with respect to oxidic components which react with the acid. When adding sulfuric acid, reaction heat is produced in the desired way by exothermal formation of sulfate. Subsequent to the mixing line (4) the dwell time tube (5) is provided, which usually has a length of more than 100 m and occasionally more than 1000 m.

In the vicinity of the preheating tube, the mixing line and the dwell time tube, there is usually ensured a static pressure of 30 to 200 bar and preferably at least 120 bar, in order to optimally achieve the desired digestion. The relief of pressure then is effected in the expansion container (6),

where steam is released, which escapes via line (6a). This steam can be used e.g. in the heating jacket (9).

Example:

In a plant corresponding to the drawing, lateritic nickel ore is treated, and in the container (1) an aqueous suspension with a solids content of 32 wt-% and a density of 1.24 kg/l is provided. Per hour, 18 m^3 of this suspension are first introduced into the preheating tube (3), and are then passed through the mixing line (4) and the dwell time tube (5).

For the mixing line (4) the following is applicable:

Pressure at the inlet: 98 bar
The temperature of the suspension at the inlet is 234°C and at the outlet 266°C.
Dwell time: 5 seconds
Flow rate of the suspension: 1.5 m/sec
Length of the mixing line: 7.5 m
Inside diameter: 70-85 mm
Thickness of the acid-resistant brick lining: about 150 mm.

Through line (12), 1.74 t/h sulfuric acid with 98 wt-% H_2SO_4 are supplied, which has a temperature of 30°C. The dwell time tube (5) has a length of 600 m, the dwell time of the suspension therein is 8 min. At the end of the tube (5) the pressure is about 108 bar and the temperature is about 273°C.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:
~~Claims~~

1. A process of leaching a lateritic ore, which contains nickel oxide and/or cobalt oxide, for preparing the extraction of at least one metal, characterized in that from water and comminuted ore, of which at least 80 wt-% have grain sizes of not more than 0.5 mm, a pumpable suspension is formed, that the ore-containing suspension is passed through an indirectly heated preheating tube, the suspension being heated to 150 to 250°C, that the heated suspension is passed through a mixing line in which an acid in a minimum amount of 10 kg per 100 kg ore, calculated anhydrous, is admixed to the suspension, and that the acid-containing suspension is passed through a dwell time tube, in which the dwell time of the suspension is at least 0.1 minutes.

2. The process as claimed in claim 1, characterized in that the ore-containing suspension is pumped into the preheating tube and in the preheating tube a static pressure of 30 to 200 bar is maintained.

3. The process as claimed in claim 1 or 2, characterized in that sulfuric acid is admixed to the suspension in the mixing line.

4. The process as claimed in any of claims 1 to 3, characterized in that the acid-containing suspension is withdrawn from the dwell time tube with temperatures in the range from 250 to 350°C.

5. The process as claimed in claim 1 or any of the preceding claims, characterized in that the suspension and the acid in the mixing line are guided along stationary flow obstacles.

6. The process as claimed in claim 1 or any of the preceding claims, characterized in that the acid is preheated to temperatures in the range from 40 to 200°C before they are introduced into the mixing line.

7. The process as claimed in claim 1 or any of the preceding claims, characterized in that the mixing line is at least partly brick-lined.

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Fig.1

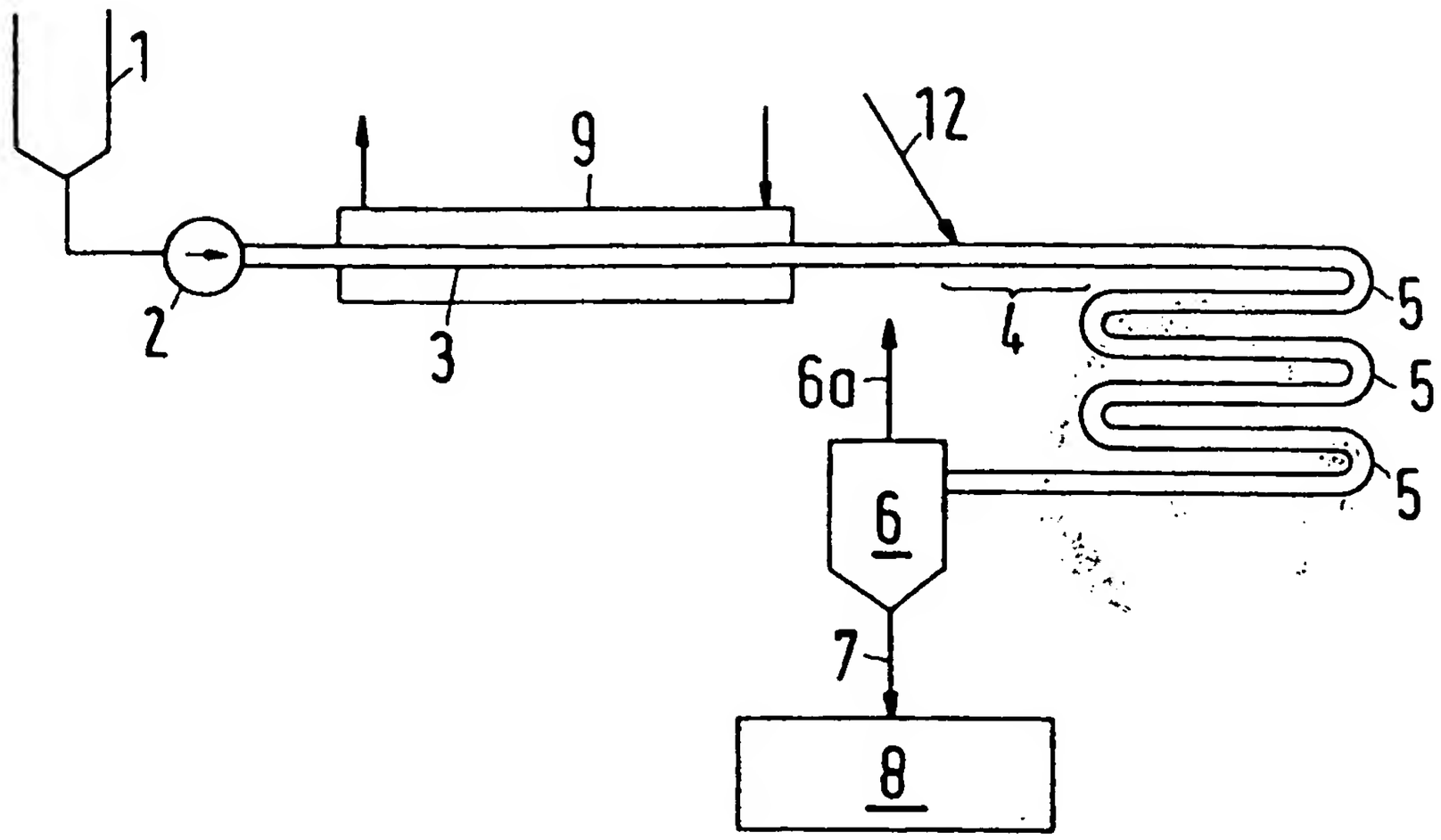

Fig.2

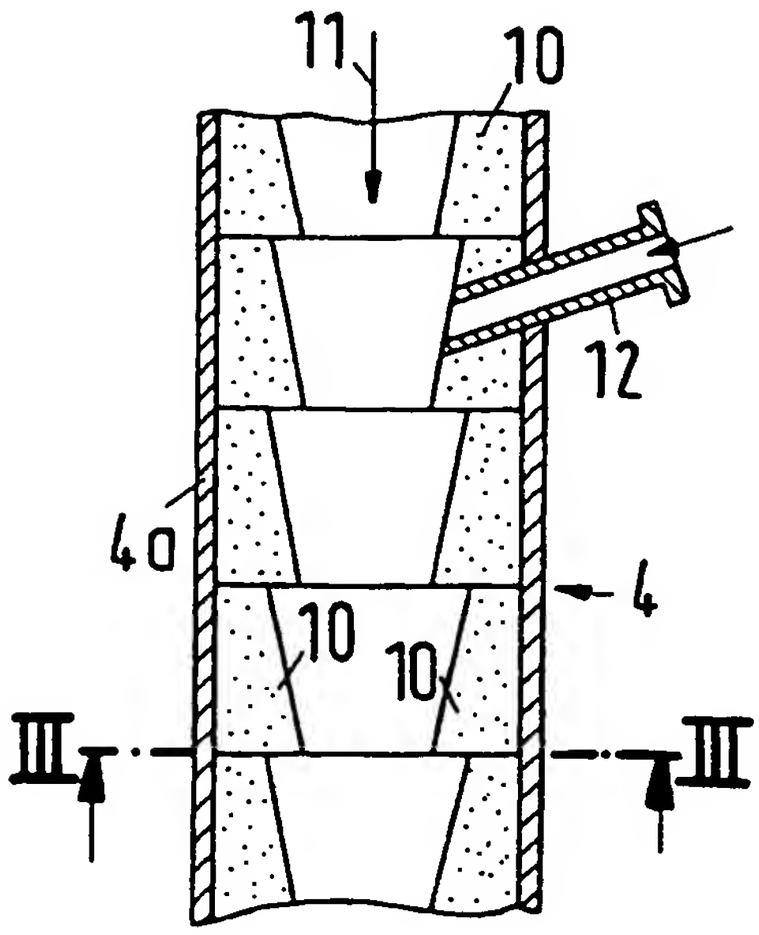

Fig.3